

GeoHealth Newsletter

The U.S. Geological Survey's Environmental Health Newsletter

What's In This Issue

- USGS Activities Related to Environmental Health
 - ◻ Environmental Health–Risk Assessment Along the Upper Santa Cruz River, United States and Mexico
 - ◻ GIS and Health at the USGS GIS Workshop and The National Map Users Conference
 - ◻ Glyphosate Found in Streams Draining Agricultural Land
 - ◻ The Slick Film on Stream Stones May Harbor Endocrine-Disrupting Chemicals
 - ◻ Volunteers AMBLE the Lake Michigan Shoreline Observing Bird Health
 - ◻ Do Wild Birds Play a Role in the Spread of Highly Pathogenic Avian Influenza (HPAI H5N1)?
- ◻ New Developments in Understanding Chronic Wasting Disease
- ◻ USGS National Wildlife Health Center Receives Prestigious International Designation by the
- ◻ World Organisation for Animal Health
- ◻ Viral Hemorrhagic Septicemia Virus in the Great Lakes
- ◻ Helping Make California Beaches Safer
- ◻ USGS Pesticide Studies Aid Salmon Conservation
- ◻ Drought, Vegetation Loss, and Dust in the Wind
- ◻ USGS Estimates Arsenic Levels in Water Supply for the New England Bladder Cancer Study
- Upcoming Meetings
- New Publications

USGS Activities Related to Environmental Health

Environmental Health–Risk Assessment Along the Upper Santa Cruz River, United States and Mexico

Inadequate water availability and poor water quality, caused in large part by extreme human population growth in the dry regions of the U.S.-Mexico border, is adversely affecting the ecology of binational watersheds. The Upper Santa Cruz River, located on the Arizona-Sonora portion of the border, is considered an important water body for its cultural, historical, and ecological value. The river supports a high diversity of plants and animals, and also sustains human communities by replenishing the groundwater aquifer, a primary regional water source. Researchers involved in the USGS's Border Environmental Health Initiative (BEHI) are investigating the potential for bioaccumulation of contaminants in the food chain within the Santa Cruz watershed. The Soil and Water Assessment Tool (SWAT) is being developed to understand how point and nonpoint source pollutants are transported through the watershed. Samples of water, soils, invertebrates, and birds are being collected and analyzed from (i.) the headwaters at San Rafael del la Zanja, which should be unaffected by downstream contaminant sources, (ii.) the Sonoita Creek tributary, which is routed through the abandoned mining district at Patagonia, (iii.) the binational Nogales Wash tributary, which flows through highly urbanized areas of Nogales, Sonora Mexico and Nogales, Arizona (photo), (iv.) the effluent of the Nogales International Waste Water Treatment Plant (NIWWTP), and (v.) the downstream confluence of these four locations at Tumacácori. These analyses will help to quantify impacts on the health of humans and wildlife and better understand the nexus among environment, wildlife, and human activities. The SWAT



Algae collection for trace metal analysis at Nogales Wash binational tributary to the Santa Cruz River (June, 2010).

Photo credit: Katie Eddleman, USGS.

model will also be used to analyze various future scenarios of land use change, climate change, and discharge from wastewater treatment plants, in terms of their effect on water quality and ecosystem health.

This study is funded by the USGS Groundwater Resources Program.

- For more information contact Laura Norman (lnorman@usgs.gov), James Callegary (jcallega@usgs.gov), Floyd Gray

(fgray@usgs.gov), or Charles van Riper III (charles_van_riper@usgs.gov),

- The Border Environmental Health Initiative - Investigating the Transboundary Santa Cruz Watershed (pubs.usgs.gov/fs/2010/3097/)
- U.S. - Mexico Border Environmental Health Initiative (BEHI) (borderhealth.cr.usgs.gov/projectindex.html)

GIS and Health at the USGS GIS Workshop and The National Map Users Conference

"The Role of Environment and Wildlife in Human Health" was a featured session at the combined 2011 USGS GIS Workshop and The National Map Users Conference. The conference took place on May 10-13, 2011 in Denver, Colorado.

Since 2004, Health sessions at the USGS GIS Workshop have showcased leading-edge geospatial tools and techniques in human health research, planning, and response. The health sessions bring together scientists from across USGS disciplines, as well as from the USGS National Biological Information Infrastructure's (NBII) Wildlife Disease Information Node (WDIN); the USDA Animal and Plant Health Inspection Service (APHIS) Veterinary Services Centers for Epidemiology and Animal Health (CEAH); the CDC Agency for Toxic Substances and Disease Registry (ATSDR) Division of Health Studies Geospatial Research, Analysis, and Services Program (GRASP); and from academic medicine.

Topics presented in 2011 included:

- Spatial associations between pesticide use and obesity in



the United States;

- GIS support to the Emergency Operations Center (www.cdc.gov/phpr/eoc.htm) of the Centers for Disease Control and Prevention (CDC) (www.cdc.gov/) during the Haiti cholera response;
- Anticipating and communicating environmental and health concerns associated with disaster scenarios (pubs.usgs.gov/of/2010/1312/);
- Mineralogical and geochemical influences on the 2010 Nigerian lead poisoning outbreak linked to artisanal gold processing (minerals.cr.usgs.gov/projects/earth_materials/index.html);
- Coal aquifers and kidney disease;
- Methods of mapping the Deepwater Horizon Oil Spill with National Aeronautics and Space Administration's (NASA) (www.nasa.gov/) Airborne Visible Infrared Imaging Spectrometer (AVIRIS) (aviris.jpl.nasa.gov/);
- USDA Animal and Plant Health Inspection Service (APHIS), Centers for Epidemiology and Animal Health (CEAH)'s (www.usda.gov) analysis and modeling of geographic distributions of tick species in the United States;
- National Biological Information Infrastructure's (www.nbii.gov/) Wildlife Health Event Reporter (www.whmn.org/wher/) and Global Wildlife Disease News Map (wildlifedisease.nbii.gov/newsmap/); and
- A natural resources assessment and favorability-mapping in support of regional planning and sustainable development in Africa. (http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTOGMC/0,,contentMDK:21092483~menuPK:509429~pagePK:210058~piPK:210062~theSitePK:336930~isCURL:Y,00.html)

Abstracts of presentations may be found in the conference's proceedings. (nationalmap.gov/uc/)

- For more information contact Yvonne H. Baevsky (yhalpern@usgs.gov), USGS New York Water Science Center
- The National Map Users Conference and USGS Geographic Information Science (GIS) Workshop (nationalmap.gov/uc/)

Glyphosate Found in Streams Draining Agricultural Land

USGS scientists and their colleagues from the National School for Water and Environmental Engineering of Strasbourg, France, (Ecole Nationale du Génie de l'Eau et de l'Environnement de Strasbourg - ENGEES) (engees.unistra.fr/site/) detected the herbicide glyphosate, along with its environmental degradation byproduct AMPA (aminomethylphosphonic acid), in streams that drain

agricultural areas in the United States and France. As usage of crops genetically modified to be resistant to glyphosate has increased, so has the use of glyphosate. The annual agricultural use within the United States has increased from 10,000 megagrams (Mg-- or 11,023 U.S. short tons) in 1992 to 80,000 Mg (88,184 tons) in 2007. Similarly, its usage throughout the world, in both agricultural and urban settings, has increased.

The scientists studied four agricultural drainage basins located in different climates in the United States and France to determine factors that affect the occurrence of the herbicide in streams. They found that many factors come into play. The complex interaction of the amount applied, time of application, the amount and frequency of irrigation or rainfall, and the route that runoff takes into streams, all contribute to how much glyphosate is lost to streams. The scientists found that in agricultural watersheds typically the total mass of glyphosate in the streams will be 1 percent or less of the amount applied.

This study was funded by the USGS National Water Quality Assessment (NAWQA) Program (water.usgs.gov/nawqa/) as part of NAWQA's study on Agricultural Chemicals: Sources, Transport, and Fate (in.water.usgs.gov/NAWQA_ACT/).

- For more information contact Richard H. Coupe (rhcoupe@usgs.gov)
- Fate and transport of glyphosate and aminomethylphosphonic acid in surface waters of agricultural basins: Pest Management Science, doi:10.1002/ps.2212 (onlinelibrary.wiley.com/doi/10.1002/ps.2212/abstract;jsessionid=A98B0C5A81EDA931FA1E271ADE1E1E49.d01t01?systemMessage=

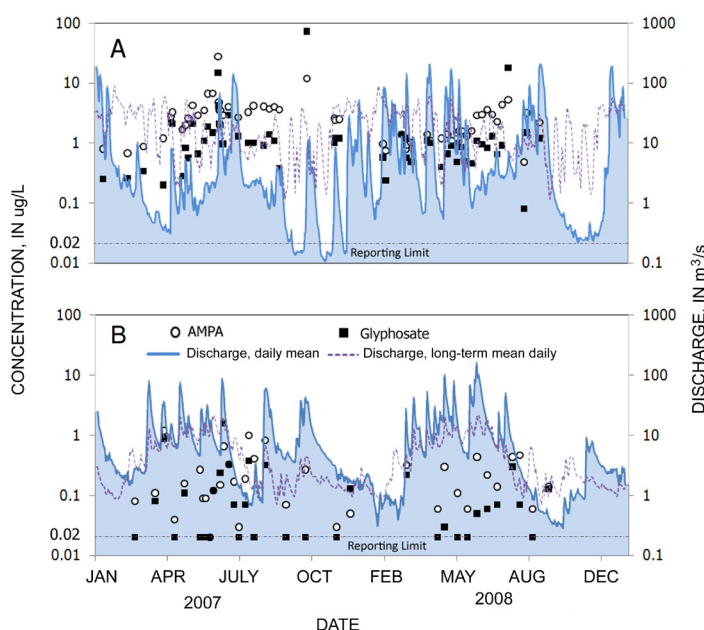


USGS scientists use strict protocols for collecting representative water-quality samples from streams. In this photo a USGS scientist is collecting a water sample from the Big Sunflower River near Harvey Chapel, Miss., for laboratory determination of pesticide concentrations. Photo credit: Marcia Woods

Wiley+Online+Library+will+be+disrupted+8+Oct+from+10-14+BST+for+monthly+maintenance)

Information on Glyphosate

- Glyphosate Found in Wastewater Discharged to Streams (toxics.usgs.gov/highlights/glyphosate_wastewater.html)
- USGS News Release: Widely Used Herbicide Commonly Found in Rain and Streams in the Mississippi River Basin (www.usgs.gov/newsroom/article.asp?ID=2909)
- Basic Information About Glyphosate in Drinking Water (water.epa.gov/drink/contaminants/basicinformation/glyphosate.cfm), U.S. Environmental Protection Agency (EPA)
- Technical Fact Sheet on Glyphosate, EPA (www.epa.gov/safewater/pdfs/factsheets/soc/tech/glyphosa.pdf)
- Glyphosate Toxicity Information, Integrated Risk Information System, EPA (www.epa.gov/iris/subst/0057.htm)
- Glyphosate, Pesticide Information Profiles, EXTOTOXNET, Extension Toxicology Network (extoxnet.orst.edu/pips/alvohosa.htm)



Concentration in stream samples of glyphosate and its degrade (AMPA), mean daily discharge and the long-term mean daily discharge in the Bogue Phalia near Leland, MS (A) and the South Fork Iowa River near New Providence, IA (B) 2007 through 2008 (Coupe and others, 2011)

The Slick Film on Stream Stones May Harbor Endocrine-Disrupting Chemicals

The slick film or "biofilm" that covers many stones in streams and rivers accumulates endocrine-disrupting chemicals, which can affect reproduction, development and other endocrine-related functions in fish. This is the finding of a team of USGS and University of Colorado scientists. The scientists sampled biofilm in Boulder Creek, Colorado. Biofilms are a mixture of algae, microbes, and organic matter that grows on streambed stones and rocks. The scientists showed

that while the chemicals can be degraded in the biofilm, it absorbs endocrine-disrupting chemicals faster than it can degrade them. Since many fish and other aquatic animals feed either directly or indirectly on biofilms the contaminants in biofilms have the potential to get transferred up the food web. Understanding how biofilms affect contaminant transport in streams is important, because persistence of these chemicals to downstream ecosystems and drinking water intakes can be affected by a stream's inherent ability to assimilate these chemicals. This team of scientists has been studying the fate

of wastewater contaminants, including endocrine-disrupting compounds in Boulder Creek downstream from the discharge of a wastewater treatment plant. This study was funded by the USGS's Toxic Substances Hydrology Program (toxics.usgs.gov/), and National Research Program (water.usgs.gov/nrp/), and the National Science Foundation (www.nsf.gov/) (Grant No. CBET-0854527).

- For more information contact Jeffrey Writer (jwriter@usgs.gov)
- Chemical Transformations in Water Reclamation and Reuse (water.usgs.gov/nrp/proj.bib/barber.html)
- Water Quality of the Boulder Creek Watershed, Colorado (www.brr.cr.usgs.gov/projects/SWC_Boulder_Watershed/)
- Emerging Contaminants in the Environment - Endocrine Disruption



USGS scientist, Jeffrey Writer, collects biofilms from stones in Boulder Creek, Colo. USGS scientists found that the biofilm that coats many of the stones on the bottom of the creek absorb endocrine-disrupting compounds.

Volunteers AMBLE the Lake Michigan Shoreline Observing Bird Health

The USGS National Wildlife Health Center (www.nwhc.usgs.gov/) sponsored a program this summer called AMBLE (Avian Monitoring for Botulism Lakeshore Events) (www.nwhc.usgs.gov/mortality_events/amble/). Fifty-two AMBLE volunteers were trained to monitor bird health and beach conditions while walking sections of the Lake Michigan and Green Bay shoreline as part of a citizen science program. The program provides an opportunity for participants to collect useful scientific data on the disease avian botulism (www.nwhc.usgs.gov/disease_information/avian_botulism/), while sharpening their birding skills and developing a connection with a wild place.

As part of the program, participants chose quarter-mile or longer sections of the Door County, Wisconsin shoreline, which they would monitor every 7 to 10 days, June through November. Expertise in bird identification was not a requirement and training was provided free of charge by National Wildlife Health Center staff. Bird mortality caused by ingestion of a toxin produced by the bacterium *Clostridium botulinum* has been reported on the Great Lakes since the 1960s. Resurgence of avian botulism outbreaks in the last decade has brought renewed attention to this wildlife health issue. AMBLE is sponsored by the USGS National Wildlife Health Center with support from the Great Lakes Restoration Initiative (cida.usgs.gov/glri/) and the following partners: The Ridges Sanctuary (www.ridgesanctuary.org), Wisconsin Department of Natural Resources (dnr.wi.gov), The Nature Conservancy (www.nature.org), Northeastern Wisconsin Audubon Society (www.newaudubon.org), Crossroads at Big Creek in Wisconsin (crossroadsatbigcreek.com), and the National Park Service's Sleeping Bear Dunes National Lakeshore (www.nps.gov/slbe), Common Coast Research and Conservation (www.commoncoast.org), and Tip of the Mitt Watershed Council in Michigan (www.watershedcouncil.org).

- For more information contact Jenny Chipault (AMBLE@usgs.gov)

- Lake Michigan Volunteer AMBLE - Avian Monitoring for Botulism Lakeshore Events (www.nwhc.usgs.gov/mortality_events/amble/)
- USGS Release: For the Birds: AMBLE Along Lake Michigan (www.usgs.gov/newsroom/article.asp?ID=2786)



Patrick Sullivan, a trained AMBLE volunteer, monitors bird health and beach conditions along Lake Michigan's shore. Patrick is part of a team of volunteers helping scientists understand the spread of the disease avian botulism among wild birds. Photo Credit: Paula Sullivan

Do Wild Birds Play a Role in the Spread of Highly Pathogenic Avian Influenza (HPAI H5N1)?

A study by the USGS, the United Nations Food and Agriculture Organization (FAO) (www.fao.org), and the Chinese Academy of Sciences (english.cas.cn) used satellites, outbreak data, and genetics to uncover an unknown link among migratory birds, domestic geese, and poultry; and the movement of the often-deadly H5N1 virus. H5N1 is a particularly virulent strain of highly pathogenic avian influenza (www.nwhc.usgs.gov/disease_information/avian_influenza/frequently_asked_questions.jsp) (HPAI) virus.

Scientists attached GPS (global positioning system) satellite transmitters to 29 bar-headed geese - a wild species that migrates across most of Asia and that died in the thousands in a 2005 bird flu outbreak at Qinghai Lake, China. GPS data showed that wild geese tagged at Qinghai Lake spend their winters in a region outside of Lhasa, the capital of Tibet where they are in close proximity to domestic geese and chicken farms where outbreaks have occurred. From 2003-2009, the Qinghai-Tibet Plateau experienced 16 confirmed HPAI H5N1 outbreaks in wild and domestic birds, most of them along the newly documented migratory pathway of bar-headed geese.

"Every summer, more than 150,000 migratory birds use Qinghai Lake, which sits within the eastern portion of the Central Asian Flyway, which extends from India to Russia," said John Takekawa, a wildlife biologist at the USGS Western Ecological Research Center.

The part that wild birds play in the spread of bird flu has been hotly debated since the 2005 outbreak at Qinghai Lake. Bird flu that spread beyond Asia and into Europe and Africa was later found to have genetically originated in the Qinghai Lake area. Discovering the Tibet connection is important to our understanding of the global transmission of bird flu. The research partnership has a website where people can follow the daily movements of the satellite-tagged birds (www.werc.usgs.gov/ResearchTopicPage.aspx?id=17).

The HPAI H5N1 virus continues to reemerge across much of Eurasia and Africa. Since 2003, H5N1 has killed 330 people, including 18 in 2010, and has led to the culling of more than 250 million domestic poultry. Sixteen countries reported H5N1 outbreaks in poultry in 2010. No evidence of H5N1 has been found in any wild migratory birds in North America in spite of extensive surveillance testing since 2006. The study was

funded by the USGS, FAO, National Science Foundation (www.nsf.gov), and the Chinese Academy of Sciences.

- For more information contact Diann Prosser (dprosser@usgs.gov) or John Takekawa (john_takekawa@usgs.gov)
- FAO-USGS Avian Influenza Projects (www.werc.usgs.gov/ResearchTopicPage.aspx?id=17)
- Avian Influenza (www.nwhc.usgs.gov/disease_information/avian_influenza/), USGS National Wildlife Health Center
- USGS News Release: New Research Suggests Wild Birds May Play a Role in the Spread of Bird Flu (www.usgs.gov/newsroom/article.asp?ID=2735)
- Highly Pathogenic Avian Influenza H5N1 Frequently Asked Questions (www.nwhc.usgs.gov/disease_information/avian_influenza/frequently_asked_questions.jsp)
- Satellite Tracking Migratory Birds (www.werc.usgs.gov/ResearchTopicPage.aspx?id=12)
- Wild bird migration across the Qinghai-Tibetan Plateau - A transmission route for highly pathogenic H5N1 (www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0017622): PLoS ONE, v. 6 no. 3, e17622, doi:10.1371/journal.pone.0017622
- Victims and Vectors: Understanding wild migratory birds and their role in highly pathogenic avian influenza transmission (www.pwrc.usgs.gov/resshow/prosser/prosser.cfm)



This bar-headed goose (*Anser indicus*) was marked with a GPS satellite transmitter at Qinghai Lake, China, in an effort to understand the role that wild birds play in the spread of highly pathogenic avian influenza. Photo credit: Diann Prosser, USGS.

New Developments in Understanding Chronic Wasting Disease

Chronic wasting disease (CWD) is a neurological disease fatal to wild deer and elk and is spreading throughout the United States and Canada. Two recent studies by USGS improve our understanding of CWD by highlighting the importance of the disease agent's persistence in the environment and by pointing to a potential means of managing it.

During the first study USGS scientists and their colleagues studied how animals come into contact with prions-

the infectious proteins that cause CWD and other neurodegenerative disorders. In the past scientists assumed that prions are transmitted only through direct animal-to-animal contact. The scientists, however, demonstrated that contact with environmental reservoirs of the prions (such as urine, feces, or the carcasses of animals) are more important for understanding disease transmission than previously thought. Their work showed that prions can be transmitted indirectly through contact with prion-contaminated materials.

“When prions are released into the environment by infected sheep or deer, they can stay infectious for many years, even decades,” said Christopher Johnson, Ph.D., a scientist at the USGS National Wildlife Health Center and the lead author of the study. “To help limit the spread of these diseases in animals, we need to be able to remove prions from the environment.”

When prions are released into the environment by infected sheep or deer, they can remain infectious for many years, even decades. Prions are notoriously difficult to decontaminate or eliminate. They are not eliminated by standard sterilization techniques- most detergents, cooking, freezing or even by autoclaving. Consequently, current management tools do not target reducing environmental transmission; instead they rely on culling deer, which has many limitations.

During the second study, USGS scientists and their colleagues found that lichens have great potential for safely reducing the number of prions. Lichens are very hardy plant-like organisms found in a host of environments. They found that some lichen species contain a protease

enzyme (a naturally produced chemical) capable of significantly breaking down prions in the laboratory. This discovery is exciting because there are few agents that degrade prions and even fewer that could be used in the environment without causing harm. Increasingly lichens are being investigated for medical applications because lichens produce unusual organic compounds that aid in their survival. USGS scientists collaborated with University of Wisconsin (www.wisc.edu), Montana State University (www.montana.edu), Pennsylvania State University (www.psu.edu), and Universidad de Antioquia (The University of Antioquia) (www.udea.edu.co) scientists. Both studies were partially funded by the USGS Wildlife: Terrestrial and Endangered Resources Program (ecosystems.usgs.gov/wter/).

- For more information contact Christopher Johnson (cjohnson@usgs.gov)
- USGS News Release: Environmental Persistence of Chronic Wasting Disease Exacerbates Deer Population Declines (www.usgs.gov/newsroom/article.asp?ID=2810)
- Modeling routes of chronic wasting disease transmission-Environmental prion persistence promotes deer population decline and extinction(www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0019896): PLoS ONE, 2011, v. 6, no. 5, e19896. doi:10.1371/journal.pone.0019896
- USGS News Release: Lichens May Aid in Combating Deadly Chronic Wasting Disease in Wildlife (www.usgs.gov/newsroom/article.asp?ID=2803)
- Degradation of the disease-associated prion protein by a serine protease from lichens (www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0019836): PLoS ONE, 2011, v. 6, no. 5, e19836, doi:10.1371/journal.pone.0019836
- Chronic Wasting Disease (CWD) (www.nwhc.usgs.gov/disease_information/chronic_wasting_disease/), USGS National Wildlife Health Center



This lichen, *Lobaria pulmonaria*, is found in northern North America. Lichens produce unique and unusual organic compounds that can have antibiotic, antiviral, and other chemotherapeutic activities. Photo Credit: Jim Bennett, USGS.



A white-tailed deer infected with chronic wasting disease (CWD), a neurological disease transmitted by unusual, infectious proteins. Photo courtesy of the Wisconsin Department of Natural Resources

USGS National Wildlife Health Center Receives Prestigious International Designation by the World Organisation for Animal Health

The USGS National Wildlife Health Center (NWHC) was recently named a Collaborating Centre for Research and Diagnosis of Emerging and Existing Pathogens of Wildlife by the World Organisation for Animal Health (OIE) (www.oie.int). The designation will facilitate collaboration with other centers within North America and beyond, including several centers within the U.S. Department of Agriculture, as well as the Canadian Cooperative Wildlife Health Centre (www.ccwhc.ca).

"International recognition for the USGS National Wildlife Health Center by the World Organisation for Animal Health could not be more prestigious or more timely. The spread of disease through wildlife respects no borders, and has been known to cross species boundaries to infect humans. As with all great honors, this one bears great responsibilities: to be ever watchful for the next outbreak, and work internationally to stop it in its tracks."

-- Marcia McNutt, Director, U.S. Geological Survey

OIE, based in Paris, France, is an intergovernmental organization responsible for improving animal health worldwide, similar to the World Health Organization (www.who.int/en) for human health. Its objectives include ensuring transparency in the global disease situation, collecting, analyzing and disseminating veterinary scientific information, and promoting veterinary services.

A critical component of OIE's scientific expertise is the network of collaborating centers (www.oie.int/en/our-scientific-expertise/collaborating-centres/list-of-centres/). These are centers of

expertise in a specific designated sphere of competence relating to management of animal health issues. Collaborating centers assist the OIE by providing their expertise internationally.

- For more information contact Gail Moede Rogall (gmrogall@usgs.gov)
- USGS News Release: USGS National Wildlife Health Center Receives Prestigious International Designation by the World Organization for Animal Health (www.usgs.gov/newsroom/article.asp?ID=2851)
- USGS National Wildlife Health Center (www.nwhc.usgs.gov)
- World Organisation for Animal Health (OIE) (www.oie.int)



The USGS National Wildlife Health Center, located in Madison, Wisconsin, provides national leadership to safeguard wildlife and ecosystem health through dynamic partnerships and exceptional science. It does this by providing information, technical assistance, training, and research on national and international wildlife health issues.

Viral Hemorrhagic Septicemia Virus in the Great Lakes

Genetic studies offer clues to an emerging virus

Viral hemorrhagic septicemia virus (VHSV) is among the most important viral pathogens of finfish-causing losses in both freshwater and marine species. In 2005-2006, VHSV emerged in



Large mortality event affecting gizzard shad in Lake Erie most likely caused by Viral hemorrhagic septicemia virus (VHSV). Photo Credit: Andrew Noyes, New York Department of Environmental Conservation.

the Great Lakes Basin causing a series of fish kills. As of June 2011, the virus has been found in 31 species of fish from Lake Superior, Lake Huron, Lake Michigan, Lake St. Clair, Lake Erie, Lake Ontario, the Niagara, and St. Lawrence Rivers, and inland lakes in New York, Michigan, Wisconsin, and Ohio. Significant outbreaks affected many species of fish, such as muskellunge, freshwater drum, goby, burbot, yellow perch, gizzard shad, and smallmouth bass. Work by USGS scientists in collaboration with state, federal, and Canadian partners focuses on: using molecular genetic tools to identify and track strains of the virus, developing improved diagnostic methods, determining methods for disinfection of eggs, and testing for transmission pathways. A three-year project funded by the Great Lakes Fishery Trust (www.glft.org) to the USGS's Western Fisheries Research Center (wfrc.usgs.gov) and colleagues at Cornell University (www.cornell.edu) and Michigan State University (www.msu.edu) has allowed USGS scientists to analyze genetic sequences of more than 100 VHSV isolates collected from 37 locations in the Great Lakes Basin. The very low level of genetic diversity found among the isolates is consistent with a recent, single introduction of the virus to a native population of fish. To date, the route of introduction has not been determined.

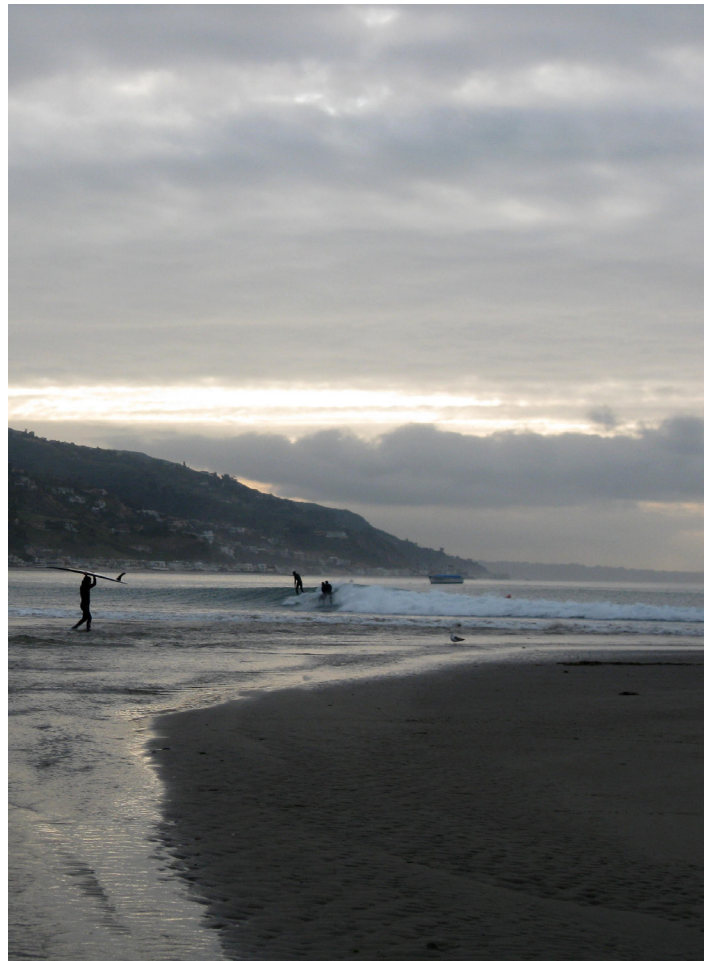
- For more information contact James Winton (jwinton@usgs.gov)
- Viral Hemorrhagic Septicemia Virus (VHS) (biology.usgs.gov/faer/vhs.html)

Helping Make California Beaches Safer

Each year, over 550 million people visit California's public beaches. To protect the millions of beach-goers from exposure to waterborne disease, California state law requires water-quality monitoring for fecal indicator bacteria, such as enterococci, at beaches having more than 50,000 yearly visitors. However, sometimes that sparkling blue water isn't as clean as it looks. Tests show that fecal indicator bacteria concentrations occasionally exceed U.S. Environmental Protection Agency public health standards at several Malibu beaches. The concern that fecal bacteria might be coming from residential onsite wastewater treatment systems prompted the City of Malibu to request a USGS study to discover the source of the occasional presence of fecal bacteria. USGS scientists found that the fecal bacteria may not be the result of human waste contamination. According to preliminary results of the study, scientists suspect possible sources of fecal bacteria are from kelp accumulated on the beach, discharge from Malibu Lagoon to the ocean, or movement of water from the lagoon through the sand berm separating the lagoon from the ocean. Regrowth or extended survival of fecal indicator bacteria from non-human sources in the lagoon is a possible contributor. Fecal indicator bacteria are used to assess the microbiological quality of water because, although not typically disease causing, they are correlated with the occurrence of certain waterborne diseases. The results of this study will help beach managers reduce the occurrence of elevated bacterial levels at these beaches.

This study was conducted in cooperation with the City of Malibu, California.

- For more information contact: Laurel Rogers (larogers@usgs.gov)
- A summary of preliminary findings is available online: <http://pubs.usgs.gov/of/2011/1091/>



Surfer wading through the discharge from Malibu Lagoon to the Pacific Ocean at Surfrider Beach, April 2010. Photo courtesy of John Izbicki, USGS.

USGS Pesticide Studies Aid Salmon Conservation

Salmon, trout, and their relatives are an extremely significant part of the West Coast ecology, culture, and economy. Sport and commercial fishing of these fish plays a vital role in the economic life of West Coast communities. The famous salmon spawning migrations are essential to the functioning of many West Coast ecosystems. However, these fish, known collectively as salmonid fishes, are threatened by man-made chemicals, including insecticides, like the organophosphate (OP) insecticide diazinon, and herbicides, like atrazine. The role of pesticides in the decline of salmonid fisheries is under debate and all four states-California, Oregon, Washington, and Idaho-are working with the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) to better characterize this relationship. To understand the effects of management practices, as well as the behavior of the chemicals themselves, USGS scientists analyzed trends for two OP insecticides and five herbicides in 15 streams throughout California and the Pacific Northwest from 1993-2005. The model they created noted several key observations:

- Regulatory changes and management practices led to decreasing concentrations of the OP insecticide diazinon in all

streams that were modeled.

- Management practices and changing crop patterns caused a downward trend in the herbicide atrazine throughout the observation period.
- The herbicide simazine has been increasing at urban sites over the last few years.
- The overall trends of these chemicals are highly influenced by irrigation, rainfall, and drainage patterns in the stream basins.

These observations and model will help the EPA, as well as the four states, evaluate the effectiveness of their management practices. In addition, California can use the model to determine whether or not total concentrations of the OP insecticide diazinon are within acceptable levels. Funding for this project was provided by the USGS National Water Quality Assessment and the Oregon and California Water Science Centers.

- For more information contact: Hank Johnson (hjohnson@usgs.gov)
- The report is available on line: Trends in Pesticide Concentrations in Streams of the Western United States, 1993-2005 (onlinelibrary.wiley.com/doi/10.1111/j.1752-1688.2010.00507.x/pdf): USGS
- Program Website: National Water Quality Assessment (water.usgs.gov/nawqa)

Drought, Vegetation Loss, and Dust in the Wind

USGS scientists found that sustained drought conditions across the Southwest United States will accelerate the loss of grasses and some shrubs and increase the likelihood of dust production on disturbed soil surfaces in the future. Accelerated rates of dust emission from wind erosion have large implications for ecosystems and human well-being, including the loss of nutrients and water-holding capacity from source landscapes, declines in agricultural productivity, and human health and safety concerns. Dust also accelerates the melting of snow, which leads to earlier delivery and less quantity of runoff entering streams and rivers. Despite these large impacts, there is poor understanding of the sources and magnitude of dust emission in a hotter and drier climate. The scientists found a mitigating factor to dust production. A combination of cyanobacteria (blue-green algae), mosses, and lichens bind the soil together in many semiarid and arid environments, creating what is known as a biological soil crust. This crust prevented wind erosion from occurring at many sites in the study, despite reductions in perennial vegetation. The scientists examined climate, vegetation, and soil measurements collected over a 20-year period in Arches and Canyonlands National Parks in southeastern Utah. Long-term data indicated that perennial vegetation in grasslands and some shrub lands declined with temperature increases, indicating likely increases in dust production and wind erosion unless the biological soil crust is not disturbed. The scientists then used the soil and vegetation measurements in a wind-erosion model and found that declines in perennial vegetation cover coupled with disturbance to biological soil crust resulted in an exponential increase in modeled wind-driven sediment flux.

This information will help inform land managers regarding air quality and visibility standards, and management of lands to protect biological soil crust, minimize wind erosion, and manage extreme runoff events from melting snowpack.

Funding for this project was provided by the USGS Climate and Land Use Change Mission Area (www.usgs.gov/climate_landuse/)

- For more information contact: Seth Munson (smunson@usgs.gov)
- The paper is available on line at: <http://www.pnas.org/content/early/2011/02/16/1014947108.abstract>
- USGS Press Release: Drier Conditions Projected to Accelerate Dust Storms in the Southwest (www.usgs.gov/newsroom/article.asp?ID=2709)



A dust storm approaching Moab, Utah. Photo courtesy of Tonya Troxler, USGS.

USGS Estimates Arsenic Levels in Water Supply for the New England Bladder Cancer Study

USGS scientists participated in a study of bladder cancer by helping to develop methods to estimate arsenic concentrations in water supplies of 2,611 participants in a population-based case-control study in northern New England.

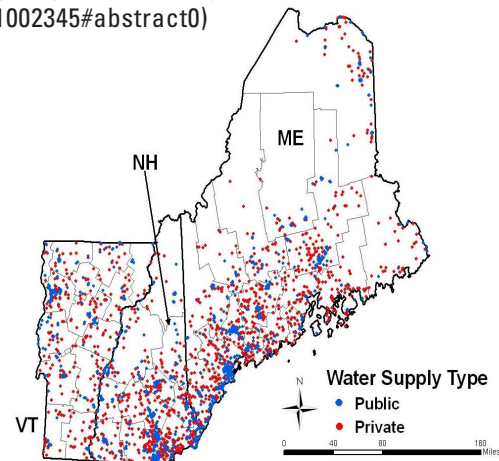
Ingestion of inorganic arsenic in drinking water from natural geologic sources is recognized as a cause of bladder cancer when levels are relatively high (for example, greater than about 150 parts per billion or micrograms per liter, µg/L). The epidemiologic evidence is less clear at the low-to-moderate concentrations typically observed in the United States.

Estimates of arsenic exposures covered the lifetimes of most study participants and included water supplies of both past and current homes. Accurate retrospective exposure assessment over long time periods is a major challenge in conducting epidemiologic studies of diseases with long latency, such as cancer.

This research was conducted in collaboration with the National Cancer Institute, Colorado State University, Dartmouth Medical School, Westat, Inc., the Maine Centers for Disease Control and Prevention, Vermont Department

of Health, New Hampshire Cancer Registry, and KP Cantor Environmental, LLC.

- For more information contact Joe Ayotte (jayotte@usgs.gov)
- This report is available online: Estimating Water Supply Arsenic Levels in the New England Bladder Cancer Study (ehp03.niehs.nih.gov/article/info%3Adoi/10.1289/ehp.1002345#abstract0)



Location of participant residence at time of enrollment (current home) by water supply type, New England Bladder Cancer Study.

Upcoming Meetings

4th International Conference on Medical Geology (GEOMED 2011) - Bari, Italy, September 20-25, 2011

The International Medical Geology Association (IMGA) and the Italian Chapter of IMGA are sponsoring the 4th International Conference on Medical Geology on September 20-25, 2011, in Bari, Italy. The conference provides an opportunity for mineralogists, physicians, soil scientists, toxicologists, geochemists, biologists, chemists, and other specialists to share ideas and knowledge on the impact of the environment on public and animal health. The conference will focus on the following themes:

- Air, Soil and Water Pollution and Quality
- Minerals and the Environment
- Environmental Toxicology and Epidemiology
- Biominerals and Biomaterials
- Risk Assessment and Communication in Medical Geology

www.geomed2011.it/

International Toxicology of Mixtures Conference, Arlington, Va., October 21-23, 2011

The conference provides a dedicated platform to the discussion and debate of current evidence-based approaches to assessing the risk of mixtures. The conference will bring together the international toxicology community to not only review the conventional models and methods but to also challenge established opinions and work towards the development of more precise modes for understanding the toxicity and predicting risk. Topics include:

- Identification & prioritization of risk of individual chemical constituents
- Clustering constituents chemicals by mode of action
- Prediction of constituent chemical interactions & non-additive toxicities
- Computing biological risk equivalents
- Integrating aggregate risk

USGS Poster Presentations

Chemical mixtures in water from public-supply wells in the U.S.- occurrence, composition, and relative toxicity by Patricia Toccalino, Julia Norman, and Jonathan Scott

www.toxicologyofmixtures.com

139th American Public Health Association (APHA) Annual Meeting and Exposition - Washington, D.C., October 29-November 2, 2011

APHA's meeting program addresses current and emerging health science, policy, environmental health, and practice issues in an effort to prevent disease and promote health. The theme for the meeting is "Healthy Communities Promote Healthy Minds and Bodies."

www.apha.org/meetings.htm

31st annual meeting of the Society for Risk Analysis, Charleston, South Carolina, December 4-7, 2011

Risk Analysis, including risk perception, risk assessment, risk management, and risk communication, represents an interdisciplinary field that is the foundation of decision making across a myriad of disciplines. The annual meeting of the Society for Risk Analysis (SRA) brings together nearly 1,000 international scientists and practitioners from a wide range of disciplines that share an interest in risk analysis.

www.sra.org/events_2011_meeting.php

Intersection of Geology and Health: Impacts of Geologic Materials on Public Health - October 9-12, 2011

Dear colleagues interested in geology and health,

Please consider submitting an abstract on your work to the upcoming session at the 2011 Geological Society of America Conference in Minneapolis, October 9-12, 2011.

T201. Intersection of Geology and Health: Impacts of Geologic Materials on Public Health

GSA Geology and Health Division; GSA Environmental and Engineering Geology Division

Geoffrey S. Plumlee, Jean M. Morrison Conveners

This session highlights the potential impacts of geologic materials (urban and natural soils, mine wastes, oil spills, smelter emissions, coal fly ash, wildfire and volcanic ash, etc.) on public health.

You can submit your abstract through the following URL: <http://www.geosociety.org/meetings/2011/sessions/topical.asp>

Scroll down to Session T201, and click on the link "Submit and abstract to this section".

Abstract submission deadline is July 26th.

Rationale for the session:

Health effects from exposure to geogenic materials are of increasing interest to the public health community, but remain poorly understood. Recent emphasis in understanding the links between geology and human health has raised many questions about exposures to natural earth materials. An interdisciplinary approach of human exposure to geologic materials such as soils (urban and natural), mine wastes, smelter emissions, coal fly ash, wildfires, volcanic ash, oil, etc. is essential in understanding potential health outcomes.

From the earth science perspective, characterization of mineralogy, geochemical reactivity, and bioaccessibility of geologic materials is crucial towards the understanding of potential pathways to human exposure. However, collaboration with health science fields is required to assess actual toxicological effects of these exposures, and to help illuminate linkages to epidemiological data on disease occurrence. This session will encourage an interdisciplinary approach to bridge the gap between geological processes and human health issues. Examples of potential invited talk topics include urban soils, artisanal mining, the Gulf oil spill, and wildfires.

There are several other sessions sponsored by the GSA Geology and Health Division to which you may want to consider submitting an abstract (70, 199, 200, 202, 203, 204).

Please feel free to contact us if you have any questions.

Thanks very much, we hope to see you in Minneapolis!

Geoff Plumlee (gplumlee@usgs.gov)

Jean Morrison (jmorrison@usgs.gov)

New Publications

Coming Soon!

Ayotte, J.D., Szabo, Z., Focazio, M.J., and Eberts, S.M., 2011, Effects of human-induced alteration of groundwater flow on concentrations of naturally-occurring trace elements at water-supply wells: *Applied Geochemistry*, v. 26, no. 5, p. 747-762 doi:10.1016/j.apgeochem.2011.01.033.

Gilbert, M., Newman, S.H., Takekawa, J.Y., Loth, L., Biradar, C., Prosser, D.J., Balachandran, S., Subba Rao, M.V., Mundkur, T., Yan, B., Xing, Z., Hou, Y., Batbayar, N., Natsagdorj, T., Hogerwerf, L., Slingenbergh, J., and Xiao, X., 2011, Flying over an infected landscape--Distribution of highly pathogenic avian influenza

H5N1 risk in south Asia and satellite tracking of wild waterfowl: *EcoHealth*, p. 1-11, doi:10.1007/s10393-010-0672-8.

Mills, C.T., Morrison, J.M., Goldhaber, M.B., and Ellefsen, K.J., 2011, Chromium (VI) generation in vadose zone soils and alluvial sediments of the southwestern Sacramento Valley, California--A potential source of geogenic CR(VI) to groundwater: *Applied Geochemistry*, doi:10.1016/j.apgeochem.2011.05.023.

Ramey, A.M., Pearce, J.M., Reeves, A.B., Franson, J.C., Petersen, M.R., and Ip, H.S., 2011, Evidence for limited exchange of avian influenza viruses Between seaducks and dabbling ducks at Alaska Peninsula coastal lagoons: *Archives of Virology*, p. 1-9, doi:10.1007/s00705-011-1059-z.

Smith, D.J., Griffin, D.W., McPeters, R.D., Ward, P.D., and Schuerger, A.C., 2011, Microbial survival in the stratosphere and implications for global dispersal: *Aerobiologia*, p. 1-14, doi:10.1007/s10453-011-9203-5.

Published Recently!

Ayotte, J.D., Szabo, Z., Focazio, M.J., and Eberts, S.M., 2011, Effects of human-induced alteration of groundwater flow on concentrations of naturally-occurring trace elements at water-supply wells: *Applied Geochemistry*, v. 26, no. 5, p. 747-762 doi:10.1016/j.apgeochem.2011.01.033.

Cappelle, J., Iverson, S.A., Takekawa, J.Y., Newman, S.H., Dodman, T., and Gaidet, N., 2011, Implementing telemetry on new species in remote areas--Recommendations from a large-scale satellite tracking study of African waterfowl: *Ostrich*, v. 82, no. 1, p. 17-26, doi:10.2989/00306525.2011.556786.

Case, B.W., Abraham, J.L., Meeker, G., Pooley, F.D., and Pinkerton, K.E., 2011, Applying definitions of "asbestos" to environmental and "low-dose" exposure levels and health effects, particularly malignant mesothelioma: *Journal of Toxicology and Environmental Health, Part B*, v. 14, no. 1-4, p. 3-39, doi:10.1080/10937404.2011.556045.

Fernandez, J.R.R., and Rocke, T.E., 2011, Use of rhodamine B as a biomarker for oral plague vaccination of prairie dogs: *Journal of Wildlife Diseases*, v. 47, no. 3, p. 765-768.

Franson, J.C., Hofmeister, E.K., Collins, G.H., and Dusek, R.J., 2011, Short report--Seroprevalence of West Nile virus in feral horses on Sheldon National Wildlife Refuge, Nevada, United States: *American Journal of Tropical Medicine and Hygiene*, v. 84, no. 4, p. 637-640, doi:10.4269/ajtmh.2011.10-0467.

Griffin, D.W., Gonzalez, C., Teigell, N., Petrosky, T., Northup, D.E., and Lyles, M., 2011, Observations on the use of membrane filtration and liquid impingement to collect airborne microorganisms in various atmospheric environments: *Aerobiologia*, v. 27, no. 1, p. 25-35, doi:10.1007/s10453-010-9173-z.

Iverson, S.A., Gavrilo, A., Katzner, T.E., Takekawa, J.Y., Miller, T.A., Hagemeijer, W., Mundkur, T., Sivananthaperumal, B., Demattos, C.C., Ahmed, L.S., and Newman, S.H., 2011, Migratory movements of waterfowl in Central Asia and avian influenza emergence--Sporadic transmission of H5N1 from east to west: *Ibis*, v. 153, no. 2, p. 279-292, doi:10.1111/j.1474-919X.2010.01095.x.

Johnson, C.J., Bennett, J.P., Biro, S.M., Duque-Velasquez, J.C., Rodriguez, C.M., Bessen, R.A., and Rocke, T.E., 2011, Degradation of the disease-associated prion protein by a serine protease from lichens: *PLoS ONE*, v. 6, no. 5, doi:10.1371/journal.pone.0019836.

Nevers, M.B., and Whitman, R.L., 2011, Efficacy of monitoring and empirical predictive modeling at improving public health protection at Chicago beaches: *Water Research*, v. 45, no. 4, p. 1659-1668, doi:10.1016/j.watres.2010.12.010.

Nuckols, J.R., Beane Freeman, L.E., Lubin, J.H., Airola, M.S., Baris, D., Ayotte, J.D., Taylor, A., Paulu, C., Karagas, M.R., Colt, J., Ward, M.H., Huang, A.-T., Bress, W., Cherala, S., Silverman, D.T., and Cantor, K.P., 2011, Estimating water supply arsenic levels in the New England bladder cancer study: *Environmental Health Perspectives*, doi:10.1289/ehp.1002345 (Advanced Web release).

Pearce, J.M., Reeves, A.B., Ramey, A.M., Hupp, J.W., Ip, H.S., Bertram, M., Petrula, M.J., Scotton, B.D., Trust, K.A., Meixell, B.W., and Runstadler, J.A., 2011, Interspecific exchange of avian influenza virus genes in Alaska--The influence of trans-hemispheric migratory tendency and breeding ground sympatry: *Molecular Ecology*, v. 20, no. 5, p. 1015-1025, doi:10.1111/j.1365-294X.2010.04908.x.

Vernati, G., Edwards, W.H., Rocke, T.E., Little, S.F., and Andrews, G.P., 2011, Antigenic profiling of *Yersinia pestis* infection in the Wyoming coyote (*Canis latrans*): *Journal of Wildlife Diseases*, v. 47, no. 1, p. 21-29.

Compiled and Edited by David W. Morganwalp

For additional information contact:

Herbert T. Buxton or David W. Morganwalp
U.S. Geological Survey
412 National Center
Reston, VA 20192
<http://health.usgs.gov/>

Each article in the on-line version of the newsletter has links to additional information.

